

### **REMARKS/ARGUMENTS**

The Applicants have carefully considered this application in connection with the Examiner's Action and respectfully request reconsideration of this application in view of the foregoing amendment and the following remarks.

The Applicants originally submitted Claims 1-33 in the application. In a previous response to an Election requirement, the Applicants elected Claims 1-11 and 23-33, consisting of Group I. Presently, the Applicants have amended Claims 1, 3 and 23, and have canceled Claim 2 without prejudice or disclaimer. The Applicants have not amended, canceled nor added any other claims. Accordingly, Claims 1, 3-4, 6, 11, 23, 25, and 31-33 are currently pending in the application.

#### **I. Rejection of Claims 1-4 under 35 U.S.C. §102**

The Examiner has rejected Claims 1-4 under 35 U.S.C. §102(b) as being anticipated by U.S. Publication No. 2003/0062577 to Rotondaro, *et al.* ("Rotondaro"). Independent Claims 1 and 23 currently include the elements of subjecting at least a portion of a metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the subjecting causing the portion to have a different work function. Rotondaro fails to disclose this element.

Rotondaro is directed to a method and system for forming dual work function gate electrodes in a semiconductor device. (Title). Rotondaro teaches that a metal layer **40** may be formed over a dielectric layer **30**. Rotondaro further teaches that a silicon-germanium layer **50** may be formed over the metal layer **40**. Rotondaro discloses that the silicon-germanium layer **50** is a conformal layer that may be deposited by any suitable means, preferably ensuring little or no

reaction between the silicon-germanium layer 50 and the metal layer 40. For example, a plasma-enhanced chemical vapor deposition, which may be carried out at relatively low temperatures, may be used to form the silicon-germanium layer 50. (See Rotondaro at paragraphs [0016] thru [0018]). Rotondaro then teaches that the silicon-germanium layer 50 is patterned to remain over a certain regions (e.g., the NMOS regions 14). Thereafter, the features are annealed to cause the silicon germanium layer 50 to react with the metal layer 40 to reduce the work function of the regions that the silicon germanium layer 50 was located over.

Notwithstanding, Rotondaro fails to disclose the claimed element of subjecting at least a portion of a metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the subjecting causing the portion to have a different work function. First, Rotondaro fails to teach a plasma silicidation or plasma germanidation process that is subjected to at least a portion of a metal gate electrode material, but teaches depositing a silicon germanium layer using a plasma-enhanced chemical vapor deposition (CVD) process. If that were not enough, the plasma process of Rotondaro is not itself affecting the work function of its metal layer 40. To the contrary, Rotondaro requires that little or no reaction between the silicon-germanium layer 50 and the metal layer 40 occur during the deposition (e.g., subjecting) of the silicon-germanium layer 50. Thus, it is not the deposition (e.g., subjecting) of the silicon-germanium layer 50 using the plasma enhanced CVD process of Rotondaro that changes its work function, but it is the subsequent anneal of the already deposited silicon-germanium layer 50 that changes the work function. These are two separate and distinct ideas. For these two reasons, among others, Rotondaro fails to disclose this claimed element.

Therefore, Rotondaro does not disclose each and every element of the claimed invention and as such, is not an anticipating reference. Because Claims 2-4 are dependent upon Claim 1, Rotondaro also cannot be an anticipating reference for Claims 2-4. Accordingly, the Applicants respectfully request the Examiner to withdraw the §102 rejection with respect to these Claims.

## **II. Rejection of Claims 1 and 6 under 35 U.S.C. §102**

The Examiner has rejected Claims 1 and 6 under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 7,071,086 to Woo, *et al.* ("Woo"). Independent Claims 1 and 23 currently include the elements of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the subjecting causing the portion to have a different work function, patterning the metal gate electrode material having the work function and patterning the portion of the metal gate electrode material having the different work function to form a first gate electrode having the work function and a second gate electrode having the different work function, and forming source/drain regions proximate the first gate electrode and second gate electrodes. Woo fails to disclose these elements.

Woo is directed to method of forming a metal gate structure with tuning of work function by silicon incorporation. (Title). Woo teaches that a transistor structure including a gate oxide 14, polysilicon gate electrode 16, gate sidewall spacers 18 and source/drain active regions 12, may be formed in/over a substrate 10. Thereafter, Woo teaches that the polysilicon gate electrode 16 may be removed to form a recess 22, and that a metal layer 26 may be formed within the recess 22. Woo then teaches that the metal layer 26 may be subjected to a plasma silane treatment. In contrast to that

which is presently claimed, however, Woo requires that its source/drain active regions 12 be formed prior to performing its plasma silane treatment. Such an order of steps is directly contrary to that which is presently claimed.

Therefore, Woo does not disclose each and every element of the claimed invention and as such, is not an anticipating reference. Because Claim 6 is dependent upon Claim 1, Woo also cannot be an anticipating reference for Claim 6. Accordingly, the Applicants respectfully request the Examiner to withdraw the §102 rejection with respect to these Claims.

### **III. Rejection of Claims 1-2, 6 and 11 under 35 U.S.C. §103**

The Examiner has rejected Claims 1-2, 6 and 11 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,291,282 to Wilk, *et al.* ("Wilk") in view of Woo. As was previously indicated, independent Claims 1 and 23 currently include the elements of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the subjecting causing the portion to have a different work function, patterning the metal gate electrode material having the work function and patterning the portion of the metal gate electrode material having the different work function to form a first gate electrode having the work function and a second gate electrode having the different work function, and forming source/drain regions proximate the first gate electrode and second gate electrodes. As was previously established, Woo fails to disclose these elements. Woo further fails to suggest such elements. Woo fails to suggest such elements because Woo teaches in great detail a process that is directly contrary to that which is claimed. Namely, Woo requires that its source/drain active regions **12** be formed many steps prior to performing its plasma silane treatment. Accordingly, Woo fails to teach or suggest the aforementioned claimed element.

Wilk further fails to teach or suggest these same claimed elements. Wilk is directed to a method for forming dual metal gate structures or CMOS devices. (Title). Wilk teaches that MOS devices **302, 304**, each including a gate electrode **306, 308**, a gate dielectric **310, 311**, gate sidewall spacers **318, 319**, and source/drain regions **312, 313, 314, 315**, may be formed over a substrate **301**. Wilk then teaches that the gate electrodes **306, 308** may be removed, and that a conductor **326** may be formed where the gate electrodes **306, 308** were removed. Wilk further teaches that prior to or

after the patterning and etching of conductor 326, one portion (or one of the gate conductors--conductor 327) is altered so as to change its work function. This can be accomplished by masking off the portion of conductor 326 (or conductor 329) and subjecting the exposed portion of conductor 326 or conductor 327 to the altering agent. Wilk teaches that this alteration may occur by subjecting the wafer to a nitrogen gas (preferably N<sub>2</sub>), which is incorporated in a plasma. However, similar to Woo, Wilk requires that its source/drain active regions 312, 313, 314, 315 be formed prior to performing its plasma nitrogen alteration. Such an order of steps is directly contrary to that which is presently claimed. Accordingly, Wilk also fails to teach or suggest the aforementioned claimed elements.

Thus, Wilk, individually or in combination with Woo, fails to teach or suggest the invention recited in independent Claims 1, 23 and their dependent claims, when considered as a whole. Accordingly, the combination must fail to establish a prima facie case of obviousness with respect to these claims. Claims 2, 6 and 11 are therefore not obvious in view of this combination.

In view of the foregoing remarks, the cited references do not support the Examiner's rejection of Claims 1-2, 6 and 11 under 35 U.S.C. §103(a). The Applicants therefore respectfully request the Examiner withdraw the rejection.

**IV. Rejection of Claims 23, 25 and 31 under 35 U.S.C. §103**

The Examiner has rejected Claims 23, 25 and 31 under 35 U.S.C. §103(a) as being unpatentable over Wilk in view of Woo and further in view of Zhu. As was previously indicated, independent Claims 1 and 23 currently include the elements of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the subjecting causing the portion to have a different work function, patterning the metal gate electrode material having the work function and patterning the portion of the metal gate electrode material having the different work function to form a first gate electrode having the work function and a second gate electrode having the different work function, and forming source/drain regions proximate the first gate electrode and second gate electrodes. As was previously established, each of Wilk and Woo alone fails to teach or suggest these elements. Accordingly, the combination of Wilk and Woo must also fail to teach or suggest these claimed elements.

Zhu fails to correct the deficiencies of Wilk and/or Woo. The Examiner is offering Zhu for the sole proposition that interconnects can be located within dielectric layers over the transistors. Notwithstanding the accuracy of the Examiner's assertions, a teaching that interconnects can be located within dielectric layers over the transistors, is very different from a teaching of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the subjecting causing the portion to have a different work function, patterning the metal gate electrode material having the work function and patterning the portion of the metal gate electrode material having the different work function to form a first gate electrode having the work function and a second gate electrode having the different work function, and forming source/drain regions proximate the first gate electrode and second gate electrodes, as is presently claimed. Accordingly, Zhu also fails to teach or suggest the aforementioned claimed elements.

Thus, Wilk individually or in combination with Woo and/or Zhu, fails to teach or suggest the invention recited in independent Claims 1, 23 and their dependent claims, when considered as a whole. Accordingly, the combination must fail to establish a prima facie case of obviousness with respect to these claims. Claims 23, 25 and 31 are therefore not obvious in view of this combination.

In view of the foregoing remarks, the cited references do not support the Examiner's rejection of Claims 23, 35 and 31 under 35 U.S.C. §103(a). The Applicants therefore respectfully request the Examiner withdraw the rejection.



**V. Rejection of Claims 23 and 32-33 under 35 U.S.C. §103**

The Examiner has rejected Claims 23 and 32-33 under 35 U.S.C. §103(a) as being unpatentable over Rotondaro in view of Zhu. As was previously indicated, independent Claims 1 and 23 currently include the element of independent Claims 1 and 23 currently include the elements of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the subjecting causing the portion to have a different work function, patterning the metal gate electrode material having the work function and patterning the portion of the metal gate electrode material having the different work function to form a first gate electrode having the work function and a second gate electrode having the different work function, and forming source/drain regions proximate the first gate electrode and second gate electrodes. As was previously established, Rotondaro fails to disclose this element. Rotondaro further fails to suggest this element. Rotondaro fails to suggest such an element because Rotondaro fails to suggest a single plasma process that changes a material's work function, let alone a plasma silicidation or plasma germanidation that changes a material's work function. Accordingly, Rotondaro fails to teach or suggest the aforementioned claimed element. It was also previously established that Zhu fails to teach or suggest such an element.

Thus, Rotondaro, individually or in combination with Zhu, fails to teach or suggest the invention recited in independent Claims 1, 23 and their dependent claims, when considered as a whole. Accordingly, the combination must fail to establish a prima facie case of obviousness with respect to these claims. Claims 23 and 32-33 are therefore not obvious in view of this combination.

In view of the foregoing remarks, the cited references do not support the Examiner's rejection of Claims 23, 28-30 and 32-33 under 35 U.S.C. §103(a). The Applicants therefore respectfully request the Examiner withdraw the rejection.

## VI. Conclusion

In view of the foregoing amendment and remarks, the Applicants now see all of the Claims currently pending in this application to be in condition for allowance and therefore earnestly solicit a Notice of Allowance for Claims 1, 3-4, 6, 11, 23, 25, and 31-33.

The Applicants request the Examiner to telephone the undersigned attorney of record at (972) 480-8800 if such would further or expedite the prosecution of the present application. The Commissioner is hereby authorized to charge any fees, credits or overpayments to Deposit Account 20-0668.

Respectfully submitted,

HITT GAINES, PC

A handwritten signature in dark ink, appearing to read 'H. Parker', is written over the printed name.

Greg H. Parker  
Registration No. 44,995

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P.O. Box 832570  
Richardson, Texas 75083  
(972) 480-8800